Hessdalen 2002: Electron Connections

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Abstract.

Hessdalen Phenomena (HP) is recognised as a sort of enigma, since it has usually shown a very particular behavior, apparently with no possible connection with other known physical phenomena. This was since 1984, when Norwegian Researcher Erling Strand began his scientific research in the Hessdalen Valley (15). Now we are analyzing a possible data connection: in the northern hemisphere around the winter solstice we have higher electron density in the plasmasphere (7) and, at the same time, higher HP sightings reported by witnesses (1a). Around the summer solstice we have the lower electron density in the higher ionosphere (7) as well as fewer Hessdalen lights reported. Is this electron density change playing an important role in the so called HP?

Some very powerful man-made radio wave injections in the atmosphere near Hessdalen are reported in order to evaluate if and how such emissions may play any role (though unexpected) in the triggering of the Phenomena, even during the low electron density season. Powerful radio injections might add energy to the atmosphere in order to trigger such phenomena. Reported times of the radio experiments appear to be in the 1980s and 1990s. This is just the time HP became known worldwide because the number of sightings reached its higher value.

Whatever HP and its origin may be, it seems that electron density in the Earth ionosphere, as well as its fluctuations in short times, has something to share with it and its triggering cause, to turn SCEBs (2) into the optical phenomena we are investigating.

It is known that very low frequency (VLF) waves, which have frequencies in the radio range from 3 to 30 kHz, are emitted, among other sources, by natural phenomena both earth- and space-based connected through the atmosphere and by very powerful man-made VLF transmitters. In the last twenty years arose the capability to generate VLF/ELF waves using powerful ground-based HF (High Frequency) radar. This is to modulate the intense auroral electroject currents that flow in the D and E ionospheric regions, causing natural currents to radiate ELF/VLF waves from an altitude range of 70-100 kilometers, though these altitude are strictly depending upon the HF frequency used (6). A number of such experiments were carried out near the Norwegian town of Tromsø, around 700 kilometers northwest from the Hessdalen Valley, during the 1980s and 1990s and later years (6a).

Below we list the most important features of these experiments, as shown in the PARS Project article by Inan and Bell at Star Lab, Stanford University (6a):

1) The Tromsø HF ionospheric heating facility successfully produced electromagnetic waves in the 200 Hz to 6.5 kHz frequency range with an amplitude of approximately 1 pT as measured on the ground. The ELF/VLF wave amplitude was roughly constant between 2–6 kHz, but dropped by 3 dB at the lower end of the frequency range.

2) The HF heater frequency generally lay within the three frequency bands: 2.75 - 4 MHz, 3.85 - 5.6 MHz, and 5.5 - 8 MHz, and the HF signal was generally 100% amplitude modulated with a square wave.

3) The HF radiated power was approximately 1 MW, and the effective radiated power (ERP) generally lay in the range of 200 to 300 MW.

4) It was generally found that X-mode polarization of the HF signal resulted in a more intense radiated ELF/VLF signal than O-mode polarization.

5) The ELF/VLF signal strength was highly correlated with magnetic activity and significantly more intense ELF/VLF waves were produced during periods of moderate geomagnetic disturbance with Kp~ 3.

6) The amplitude of the ELF waves was essentially independent of the ERP of the HF signal, but depended only on the total HF power delivered to the ionosphere.

7) The ratio of heating to cooling time constants ranged from 1 at 510 Hz to 0.3 at 6 kHz.

The Tromsø facility was also used to excite ULF waves in the 1.67 - 700 mHz frequency range [Stubbe and Kopka, 1981; Stubbe et al., 1985; Maul et al., 1990]. A variety of HF modulation schemes were attempted. The amplitude of the excited ULF waves were of the order of 100 - 10,000 pT (6a).

Once the VLF waves are sent out, they travel up through the ionosphere to the Earth's magnetosphere. Because of this disturbance, they cause many natural emissions such as whistlers, which are waves in the audio range. The electrons caught in the whistlers spiral along the lines of force in the Earth's magnetic field until they reach the opposite hemisphere, at the magnetic conjugate point. When they reach the magnetic pole and hit the Earth's atmosphere, they precipitate into the atmosphere. This phenomenon of electron precipitation is similar to what causes the aurora borealis or Northern Lights.

Physical Data Analogies.

Northern Lights are an astonishing natural phenomena, showing a number of colors in the atmosphere, at about the same geographical and magnetical coordinates as the Hessdalen Valley, worldwide. But we are experiencing Hessdalen Phenomena only in that Norwegian area. Moreover Northern Lights appear to be slow motion or even an almost stationary phenomena, compared to the very fast changing and moving Hessdalen Lights. Even though the Northern Lights are very different phenomena from the Hessdalen Lights, they may have composition or triggering causes in common.

In this perspective we should take in account the ongoing influence of a high speed solar wind stream, the I.M.F., in order to understand the magnetic field based influence in the Hessdalen area.

Following information from the Valley as well as statistical studies (1a), data from observations in the Hessdalen Valley refer to a fall-winter time as the higher sightings season (the months around the Winter Solstice). In particular it seems that October to February is the most important sightings season, while June to July, and maybe first week of August too, is the minor one (the months around the Summer Solstice). It also may be due to the most dark and light seasons through the year in that northern region (15). In addition to these two periods, the reported peak time during the day, around midnight (1-1a-3-15), correlates well with electron density through the seasons in the ionospheric F-layer and beyond in the plasmasphere.

In the October-March season, according the reported sources, we measure the highest electron density per cubic meter with a peak in the beginning of January. In the June to July season we experienced the lowest density rate.

These data did appear since the observations of R.A. Helliwell at Stanford University in the ’60s (7) as shown in various sources (9-14-16), though it is not possible to collect electronic density data over just the Hessdalen area, since there is no observatory in the Valley. For this reason we have used the Ny Alesund Observatory. Though it is far North from Hessdalen (11.8700 East; 78.9200 North), it is the only Norwegian Electron Observatory available to provide this data. Though the F-layer is the highest ionospheric region and the plasmasphere is even higher, a strong electric field builds up on the ground whose polarity is most often such that it pushes the F-layer aside allowing energetic electrons from the higher ionospheric layers to penetrate to lower levels. This may be connected with the very high electricity reported in the very low atmosphere, during all the EMBLA Missions (1–2 and 2b), as well as L.E.P. phenomena (11-12) and, on the other hand, the whistler propagation path (7), reaching the lower atmospheric layers and the ground itself. Electrical ducts can actually push particles downward as well.

In the PARS Project, Authors Inan and Bell (StarLab at Stanford University) proposing possible accompanying ionospheric effects due to induced precipitation of energetic electrons, generated by HAARP HF emissions, able to stimulate ELF/VLF signals as well as such ionospheric effects (6a). Though it is unexpected to do so, manmade activity may excite the needed overall condition in ionosphere and atmosphere to get the condition usually created by nature, to induce higher electron temperature and precipitation of energetic electrons toward the lower ionospheric as well as atmospheric layers.

This situation may induce electron fluctuations, able to produce a favorable condition to trigger optical phenomena in the low atmosphere, breaking SCEBs, with no (or partial) need of natural seasonal connections.

Electron Density Hypothesis:

Final Remarks.

As I stated earlier, information from the Valley inhabitants leads us to consider the possibilities that Hessdalen Phenomena tend to appear most during the fall-winter season, while during summer we experience the fewest reports (1a). This may come from the long darkness of winter days as well as the long daylight of summer days, of course. Since this is strong statistical evidence, we should take care to determine if something may arise around the solstices (winter and summer).

For this purpose we can consider weather connections (temperature, pressure, humidity and connected electricity in the atmosphere) as it is done in many important papers from Russian scientists in the Ball Lighting (BL) theories (17 - 18). In some cases it seems that BL hypothesis shows good connections with the Hessdalen Phenomena.

Around the winter and summer solstices we are experiencing another interesting situation related to electron density. It may be important to take into account one more possibility: very powerful HF radio injections in the ionosphere from ground based stations. One of these is located at Trømso, a Norwegian town about 700 km north of the Hessdalen valley. This last factor may give an unexpected contribution to create the atmospheric condition (electron precipitation) able to trigger optical phenomena at various distances, depending the HF radio frequency used, even when the natural conditions are not the ideal ones. At the same time, powerful radio HF emissions are likely able to boost favourable natural conditions in order to increase electron temperature and precipitation to the lower ionospheric regions. Riometer measurement may give an important cross-reference in order to confirm this hypothesis, since cosmic natural noise from space should get higher after electrons missing the higher ionosphere layers. Since many worldwide stations are used to put very powerful radio emission in the ionosphere, this one may be a good way to understand the so called Hessdalen-like-Phenomena even in other world regions.

It is my will to propose a research path that appears to be promising though lacking very close Hessdalen Valley-based research. As in my previous work about this subject, I have used observations in the ionospheric electron field, worldwide, in order to better describe measured data from scientific observatories. These data are easily available through the Reference section at the end of my work. I use them for HP research purposes, asking for deeper research in this field, in order to give a new perspective to the Hessdalen Phenomena. Moreover I propose scientific and technical ways to realize my hypothesis through analysis of existing data.

A Point of View.

Using the reported (19) analogies, we'll speculate a little bit more, hypothesising that the phenomena triggering the Hessdalen Lights may be in some way connected to the electron density in the plasmasphere, down to lower atmosphere layers, through the reported means. We could maybe say that the SCEBs transforming to be visible is related to the electron quantity found along their path, as if the SCEB inner composition elements would break apart due to such high electron density.

The electron density (ED) as well as electron irregularities, or fluctuations, in the channel driving electrons down toward the very low atmosphere might trigger optical phenomena. High electron density or fast electron fluctuations may break SCEBs, providing energy for their optical phenomena and lights, as well as their apparent erratic movement that may be induced by following electronic currents in the lower atmosphere. Considering the highest or the lowest ED, SCEBs-then-lights-(HP) may vary direction and speed and acceleration, according the ED ratio between the area where they are at a given time and one of the closest areas reporting highest electron density. A particular ED ratio around a given area can give variation of direction towards the area reporting higher ED at that moment. Acceleration will change according with the ED ratio between the place where SCEBs/HP are on a given time and the closest one with highest ED (i.e. acceleration toward that area, as if highest Electron Density difference acts as an attraction machine for SCEB and/or HP). Even a 90° turn may be observable if the ED ratio offers favorable conditions (great attraction strength based upon very high density difference between contiguous areas) in that direction. On the other hand, an ED equilibrium on a given region (more contiguous areas), may give SCEB/HP slow motion (more or less depending on that ED balance and reduction in the region) or remaining stationary as long as this equilibrium persists. If no zone prevails, the SCEBs/HP may remain still until its energy will go shining and rolling down to the ground if and when gravitational forces will prevail.

Otherwise, lights will disappear in the air as soon as the mix is burned off (i.e. inside energy ends after the Self Contained Energy Bag is broken). On the other hand, one more electron channel coming from ionosphere may perturb our area, inducing SCEB/Light to re-start again with an acceleration according with the electron density difference between the old (almost zero) and the new area. This new electron duct should improve the HP brightness and its colors in a proportional way with the original particles still inside SCEB/HP.

Summing up: If one area on a given electronic current will prevail, we'll observe the light accelerate toward that direction with acceleration in close relationship to the ED ratio between the different currents in different directions.

The relationship is the one between the channel (with its electron density) where light exists at a given time and all adjacent channels (with their own electron density).   Looking at Electron Density as HP fuel we can even say that when they exhaust the fuel in their vicinity, they drift toward regions with more.

Optical phenomena will move itself accordingly with electron fluctuation actually found in the areas where it will travel.

Confirming such a hypothesis may be possible using the technique of measuring the ED or Total Electron Content (TEC) per square-meter to monitor ionospheric irregularities in the Hessdalen region (around 63° 78' North-11°17' East). Anyway, until now, little data is available for ED or TEC in that specific area (16). Just TEC from Tromsø (69.6600 North - 18.9400 East) and Ny

Alesund (78.9200 North -11.8700 East) are available on a regular basis, though Tromsø public information has suffered severe discontinuities lately (16). More good information may arise from Riometer in the Scandinavian region, for the reported electrons missing in the higher ionosphere regions, by natural and manmade activity.

Research done in 1997 in the southern hemisphere by Yue-Jin Wang, P. Wilkinson and J. Caruana at IPS Radio and Space Services, gave interesting results. GPS satellites orbit with semi-synchronous periods, their position is repeated from one day to the next with roughly four minutes shift due to sidereal motion. In this way we can observe that the most severe phase TEC fluctuations occurred at a latitude approximately the same as the station (63ºS Dip latitude), lasting for more than one hour (9).

That Latitude is in good accord with the Hessdalen one, though on the opposite hemisphere, and the time TEC phase fluctuations last may resemble some of the longer, in time, Hessdalen phenomena.

Southern data as well as northern data from Trømso (two radar frequency: 931 MHz and 2.800 Hz) (13) and Ny Alesund, Far Northern Norway, (16), seems to confirm that ED in higher quantity and Hessdalen Phenomena have something to share with the winter solstice.

It may be a starting point, since HP has always been a complex phenomena to investigate with useful comparisons with other physical events and data.

Now it seems we have a path to follow comparing data from ED, powerful manmade HF radar emission, SCEBs and HP. It is important to measure electron temperature and precipitation induced by very powerful emission from ground stations worldwide, Norway included. Transmitting stations may create the needed electron situation (temperature, precipitation, fluctuations and higher charge) for breaking SCEBs and triggering HP. Any season may be the right one, when powerful manmade emissions are working, though the more successful, are likely the ones done around the winter solstice. A joint activity: natural and manmade. But the very focal point should be Electron Density/SCEB relationship: is this the triggering subject?

Just food for thought.

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